We Claim:

1. A method of reducing noise in a multiple carrier modulated (MCM) signal that has been equalized, the method comprising:

estimating impulse noise based in the equalized signal; and

removing a portion of the noise upon the equalized signal as a function of the estimated impulse noise.

2. The method of claim 1, wherein the multi-carrier-modulated signal is an orthogonal frequency-division multiplexing (OFDM) signal.

3. The method of claim 1, wherein the removing step removes the portion also as a function of an estimated channel transfer function ($\hat{\mathbf{H}}$).

4. The method of claim 3, wherein at least part of the removing step takes place in a frequency domain.

5. The method of claim 4, wherein the removing step removes the portion by

taking the matrix product of the estimated impulse noise and an inverse ($\hat{\mathbf{H}}^{-1}$) of $\hat{\mathbf{H}}$, and

subtracting the product from the equalized signal.

6. The method of claim 3, wherein at least a part of the removing step takes place in a time domain.

7. The method of claim 6, wherein the removing step includes

subtracting the time-domain approximated impulse noise from the received signal to form a compensated version of the received-signal.

8. The method of claim 7, wherein the removing step further includes

taking the fast Fourier transform (FFT) of the time-domain compensated received-signal to produce a frequency-domain version of the compensated received-signal, and

taking the product of the frequency-domain version of the compensated received-signal and an inverse ($\hat{\mathbf{H}}^{-1}$) of $\hat{\mathbf{H}}$.

9. The method of claim 1, wherein the estimating step includes

approximating total noise in the equalized signal, and

approximating the impulse noise based upon the approximated total noise.

10. The method of claim 9, wherein at least part of the step of approximating the impulse noise takes place in a time domain.

11. The method of claim 10, wherein the step of approximating the impulse noise includes:

using peak-detection to produce a time-domain version of the estimated impulse noise based upon a time-domain version of the approximated total noise.

12. The method of claim 9, wherein at least part of the step of approximating the total noise takes place in a frequency domain.

13. The method of claim 12, wherein the step of approximating the total noise includes:

estimating a baseband signal that includes a set of transmitted symbols;

subtracting the estimated baseband signal from the equalized signal to form a set of differences; and

multiplying the set of differences by an estimated channel transfer function ($\hat{\mathbf{H}}$).

14. The method of claim 9, wherein at least part of the step of approximating the total noise takes place in a time domain.

15. The method of claim 14, wherein the step of approximating the total noise includes:

estimating a baseband signal that includes a set of transmitted symbols;

taking the matrix product of the baseband signal and an estimated channel transfer function ($\hat{\mathbf{H}}$) to form a frequency-domain product;

taking the inverse fast Fourier transform (IFFT) of the frequency-domain product to form a time-domain version of the product;

subtracting the time domain product from the received signal to form a time-domain version of the estimated total noise.

16. The method of claim 1, wherein:

the estimating step and the removing step can be performed iteratively, a first such iteration resulting in a first noise-reduced version of the equalized signal; and

the method further including

making a second iteration of the estimating step and the removing step in which the estimating step operates upon the first noise-reduced version of the equalized signal;

the second iteration producing a second noise-reduced version of the equalized signal which has a lower noise content than the first version.

17. The method of claim 16, further comprising:

making a third iteration of the estimating step and the removing step in which the estimating step operates upon the second noise-reduced version of the equalized signal;

wherein the third iteration produces a third noise-reduced version of the equalized signal which has a lower noise content than the second version.

18. The method of claim 1, further comprising:

clipping, prior to equalizing the MCM signal, peaks above a threshold;

wherein the equalized signal is an equalized version of the clipped MCM signal.

19. The method of claim 18, wherein the clipping step clips the MCM signal to either a threshold level or to zero.

20. An apparatus for reducing noise in a received multiple carrier modulated (MCM) signal, the apparatus comprising:

a Fourier transformer operable upon the received MCM signal;

an equalizer operable to equalize a Fourier-transformed signal from the Fourier transformer; and

a total-noise estimator operable to estimate a total noise in the equalized signal from the equalizer;

an impulse-noise estimator operable to estimate impulse noise based upon the estimated total-noise; and

a noise compensator operable to remove a portion of impulse-noise on the equalized signal as a function of the estimated impulse-noise.

21. The apparatus of claim 20, wherein the MCM signal is an orthogonal frequency-division multiplexing (OFDM) signal.

22. The apparatus of claim 20, wherein the noise compensator is operable also as a function of an estimated channel transfer function ($\hat{\mathbf{H}}$).

23. The apparatus of claim 22, wherein removal by the noise compensator is in a frequency domain.

24. The apparatus of claim 23, wherein the noise compensator is operable to remove by

taking the matrix product of the estimated impulse noise and an inverse ($\hat{\mathbf{H}}^{-1}$) of $\hat{\mathbf{H}}$, and

subtracting the product from the equalized signal.

25. The apparatus of claim 22, wherein removal by the noise compensator is in a time domain.

26. The apparatus of claim 25, wherein the noise compensator is further operable to remove by

subtracting the time-domain approximated impulse noise from the received MCM signal in the time domain to form a compensated signal.

27. The apparatus of claim 26, wherein the noise compensator is further operable to:

take the fast Fourier transform (FFT) of the time-domain compensated signal to produce a frequency-domain version of the compensated signal; and

take the product of the frequency-domain version of the compensated signal and an inverse ($\hat{\mathbf{H}}^{-1}$) of $\hat{\mathbf{H}}$.

28. The apparatus of claim 20, wherein the impulse-noise estimator is operable to estimate the impulse noise in the time domain.

29. The apparatus of claim 28, wherein the impulse-noise estimator is operable to estimate by

using peak-detection to produce a time-domain version of the estimated impulse noise based upon a time-domain version of the approximated total noise.

30. The apparatus of claim 20, wherein the total-noise estimator is operable to provide the estimated total noise in the frequency domain.

31. The apparatus of claim 30, wherein the total-noise estimator is operable to approximate the total noise by:

estimating a baseband signal that includes a set of transmitted symbols;

subtracting the estimated baseband signal from the equalized signal to form a set of differences; and

multiplying the set of differences by an estimated channel transfer function ($\hat{\mathbf{H}}$), respectively.

32. The apparatus of claim 20, wherein the total-noise estimator is operable to provide the estimated total noise in the time domain.

33. The apparatus of claim 32, wherein the total-noise estimator is operable to approximate the total noise by:

estimating a baseband signal that includes a set of transmitted symbols;

taking the matrix product of the baseband signal and an estimated channel transfer function ($\hat{\mathbf{H}}$) to form a product;

taking the inverse fast Fourier transform (IFFT) of the product to form a time-domain version of the product;

subtracting the time domain product from the received signal to form a time-domain version of the estimated total noise.

34. The apparatus of claim 20, wherein one of the following applies:

the equalizer is operable to determine an inverse ($\hat{\mathbf{H}}^{-1}$) of an estimated channel transfer function ($\hat{\mathbf{H}}$) and the noise compensator is operable to invert $\hat{\mathbf{H}}^{-1}$ to produce $\hat{\mathbf{H}}$;

the equalizer is operable to determine $\hat{\mathbf{H}}$ and the noise compensator is operable to produce $\hat{\mathbf{H}}^{-1}$; and

the equalizer is operable to produce both $\hat{\mathbf{H}}^{-1}$ and $\hat{\mathbf{H}}$.

35. The apparatus of claim 34, wherein:

the total-noise estimator, the impulse-noise estimator and the noise compensator are arranged in a first stage and the noise-reduced version of the equalized signal is a first such version; and

the apparatus further includes at least a second stage having corresponding

a second total-noise estimator operable upon the first noise-reduced version of the equalized signal fed back thereto,

a second impulse-noise estimator, and

a second noise compensator operable to output a second noise-reduced version of the equalized signal which has a lower noise content than the first version.

36. The apparatus of claim 35, wherein the second total-noise estimator is also operable upon the received signal fed forward thereto.

37. The apparatus of claim 35, wherein the apparatus further comprises at least a third stage having

a corresponding third total-noise estimator operable upon the second noise-reduced version of the equalized signal fed back thereto,

a third impulse-noise estimator and

a third noise compensator operable to output a third noise-reduced version of the equalized signal which has a lower noise content than the second version.

38. The apparatus of claim 37, wherein the second total-noise estimator is also operable upon the received signal fed forward thereto.

39. The apparatus of claim 20, wherein:

the apparatus further comprises a first fast Fourier transformer (FFT) to provide a frequency-domain version of the received signal to the equalizer; and

the impulse-noise estimator includes an inverse FFT (IFFT) and a second FFT,

the IFFT providing a time-domain version of the total noise,

the impulse-noise estimator being operable to provide a time-domain estimate of the impulse noise based upon the time-domain estimated total noise, and

the second FFT being operable to provide a frequency-domain version of the estimated impulse noise.

40. The apparatus of claim 20, wherein:

the impulse noise estimator is operable, in part, to make an inverse fast Fourier (IFF) transformation;

the noise compensator is operable, in part, to make a fast Fourier (FF) transformation;

the apparatus further comprises a fast Fourier transformer (FFT);

the apparatus being configured to selectively connect the FFT according to at least three layouts,

the first layout having connections such that operation of the FFT can provide a frequency-domain version of the received signal to the equalizer,

the second layout having connections such that operation of the FFT can form a part of the IFF transformation, and

the third layout having connections such that operation of the FFT can form a part of the FF transformation.

41. The apparatus of claim 40, wherein:

the first, second and third layouts are part of a first arrangement and the noise-reduced version of the equalized signal is a first such version; and

the apparatus further being organized to selectively adopt a at least a second arrangement in which the second layout operates upon the first noise-reduced version of the equalized signal fed back thereto; and

the noise compensator in the second arrangement is operable to output a second noise-reduced version of the equalized signal which has a lower noise content than the first version.

42. The apparatus of claim 41, wherein:

the apparatus is further being organized to selectively adopt at least a third arrangement in which the second layout operates upon the second noise-reduced version of the equalized signal fed back thereto; and

the noise compensator in the third arrangement is operable to output a third noise-reduced version of the equalized signal which has a lower noise content than the second version.

43. An apparatus for reducing noise in a multi-carrier-modulated (MCM) signal, the apparatus comprising:

a down-converter;

an analog to digital converter to digitize the output of the down-converter;

a guard-interval removing unit operable upon the digitized output of the down-converter; and

a combined FFT, equalization and impulse-noise-compensation unit operable upon a signal from the guard-interval-removing unit.

44. The apparatus of claim 43, wherein the combined FFT, equalization and impulse-noise-compensation unit includes:

an equalizer operable upon signal from the guard-interval removing unit;

a total-noise estimator operable upon a signal from the equalizer;

an impulse-noise estimator operable upon a signal from the total-noise estimator; and

a noise compensator operable upon the signal from the equalizer and the signal from the impulse-noise estimator.

45. The apparatus of claim 43, wherein the multi-carrier-modulated signal is an orthogonal frequency-division multiplexing (OFDM) signal.

46. A method of reducing noise in a received multiple carrier modulated (MCM) signal that has been partially equalized, the method comprising:

estimating impulse noise based upon the partially-equalized signal; and

removing a portion of the noise in the received signal in the time-domain as a function of the estimated impulse noise.

47. The method of claim 46, wherein:

the removing step produces a time-domain compensated signal; and

the method further comprises

equalizing a frequency-domain version of the compensated signal.

48. The method of claim 47, wherein the equalizing step equalizes as a function of an estimated channel transfer function ($\hat{\mathbf{H}}$).

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